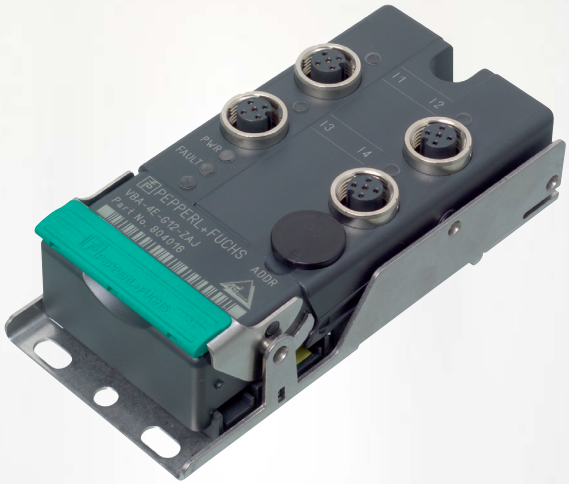
VAA-2E2A-G12-SAJ/EA2L

Version 1.0

Manual



Safety at Work

CE

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With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Declaration of Conformity

This product was developed and manufactured in line with the applicable European standards and directives.

Note

A declaration of conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs Group, 68307 Mannheim, Germany, has a certified quality assurance system that conforms to ISO 9001.

ISO**9001**

2 Safety

2.1 Symbols Used

Safety-Relevant Symbols



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols



Note

This symbol brings important information to your attention.



Action

1. This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

2.2 Intended Use

The device can be used as a safety module with safety-related inputs for connecting mechanical contacts, such as emergency-stop switches, and an optional conventional electronic output, e.g., to activate signal lights. When used in this way in conjunction with a programmed AS-Interface safety monitor, the device allows operation of sensor-controlled personal protective equipment up to category 4/PL e as per ISO 13849-1, or up to SIL 3 as per EN/IEC 62061.

The maximum service life of the AS-Interface safety module is 20 years. Replace the device as a matter of course after 20 years at the latest.

Safety Classification

The module contains two independent, redundant input channels. If both input channels are used, the module is suitable for use up to category 4/PL e in accordance with ISO 13849-1, or SIL 3 in accordance with EN/IEC 61508 and EN/IEC 62061. In this case, the monitor must be programmed so that dual-channel switching is monitored.

If a single-channel switch is used, the module is suitable for use up to category 2/PL c in accordance with ISO 13849-1, or SIL 1 in accordance with EN/IEC 61508 and EN/IEC 62061. Only tested and certified power supplies with safe isolation may be used to supply power. These power supplies must have PELV voltage in accordance with EN 50295/IEC 62026-2, and a minimum MTBF of 50 years. The power supplies are designed to exclude a short circuit between the primary and secondary sides.



Danger!

Incorrect device connection.

Do not use the outputs for safety-integrated functions.

Approvals

The device is approved in accordance with ISO 13849-1 and EN/IEC 62061.

2.3 General notes on safety

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. The protection of operating personnel and the plant is guaranteed only if the device is operated in accordance with its intended use.

Installation and commissioning of all devices may be performed only by trained and qualified personnel.

Only instructed specialist staff may operate the device in accordance with the operating manual.

It is dangerous for the user to make changes and/or repairs. Additionally, doing so voids the warranty and excludes the manufacturer from any liability. In the event of any serious errors, stop using the device. Secure the device against unintended operation. To have the device repaired, return it to your local Pepperl+Fuchs representative or your sales center.

Only qualified electrical specialists are authorized to perform maintenance work.

Do not open the device.

Maintain ambient conditions for IP67.

The operating company bears responsibility for observing locally applicable safety regulations.

2.4 Safety Monitor Requirements

The device must be used only as intended as a safety-related slave in an AS-Interface segment with the corresponding AS-Interface Safety Monitor. The AS-Interface Safety Monitor must meet the requirements of the "Specification of Safe AS-Interface Transmission" system specification (version 2.01) dated 05/12/2000.

To evaluate a safety-related function in accordance with a safety standard, all components found in the function must be evaluated in accordance with this standard.

The wiring and programming of the safety monitor determine whether or not the required safety function performs correctly. This also applies to the required safety response after a code fault or failure (see also safety monitor documentation). The safety function (including all safety-related sensors) must be checked prior to initial commissioning. The safety monitor Performance Level or Safety Integrity Level (SIL) must, as a minimum, comply with the Performance Level or SIL required by the application.

If a restart interlock is required for the safety function, this restart interlock must be implemented in the safety monitor.

2.5 Cabling Requirements

The requirements set out in EN/IEC 60204-1 must always be observed. The requirements for the external cabling and selection of connected switches and/or mechanical contacts are based both on the level of functionality to be achieved, and on the required category (ISO 13849-1 or EN/IEC 61508).

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Caution!

Protected cable installation

Protect the cable of the safe inputs against mechanical damage in accordance with the requirements set out in EN/IEC 60204-1.

In danger of manipulation, install connectors so that they are inaccessible to the operating personnel.

2.6 Switch or mechanical contact requirements

The switches must be spring loaded. Switches combinations that guarantee an equivalent safety status (malfunction analysis) can be used.

2.7 Transfer time of safety-relevant information

The transfer time depends mainly on the monitor. Read the corresponding documentation and actuating element disconnecting times.

2.8 Probability of Failure on Demand Calculation

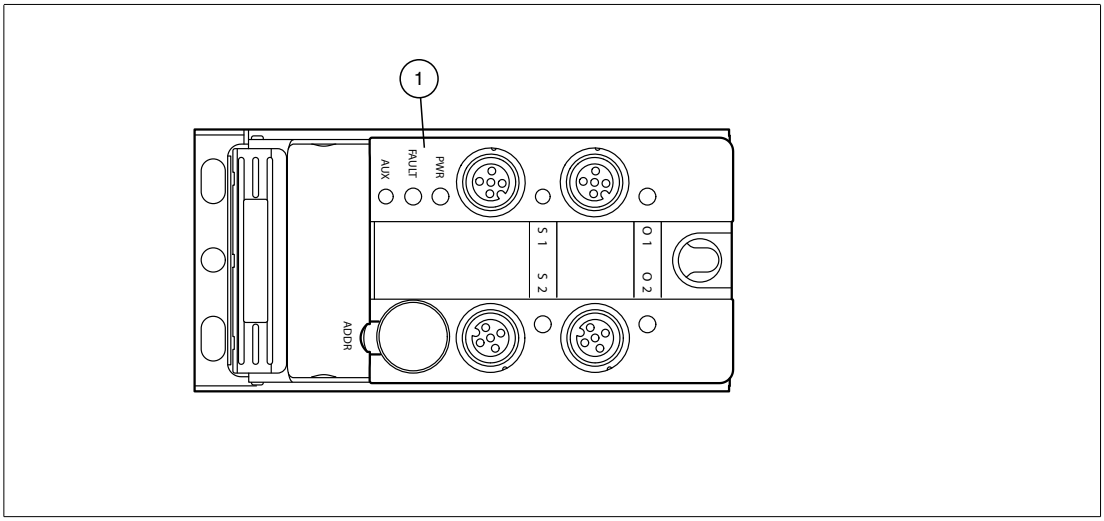
To calculate the probability of dangerous failure on demand (PFD) of a safety-related function, the PFD values for all components used within this function must be taken into consideration. In the case of dual-channel applications, the AS-Interface safe input module does not significantly contribute to the PFD or PFH (probability of dangerous failure per hour) of the overall system.

The PFD and PFH values for single-channel application can be found in the data sheet. The PFD or PFH values of the other components, in particular the safety monitor, can be found in the relevant documentation.

3 Product Description

3.1 LED indicators and control buttons

The device has the following indicators:



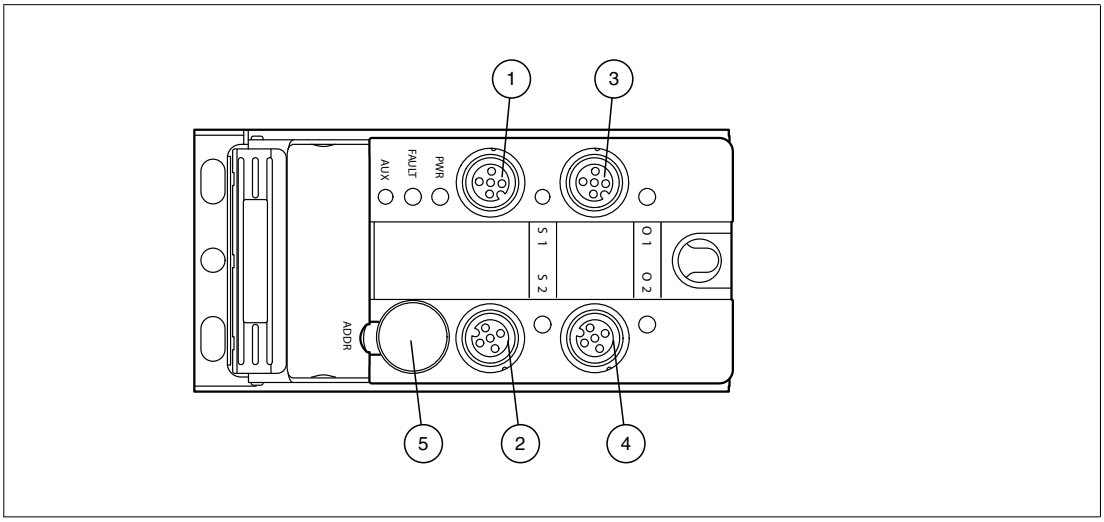
1. Status indicators

Indicators

Designation	Description
FAULT	Fault indicator; LED red • Red: communication error or address is 0 • Red flashing: output supply overload
PWR	AS interface voltage; LED green • Green: voltage OK • Green flashing: address 0
AUX	External bulk power UAUX; dual LED green/red • Green: voltage OK • Red: voltage, poles reversed
S1	Switching status of input channel 1; LED yellow
S2	Switching status of input channel 2; LED yellow
OUT1	Switching status of output 1; LED yellow/red • Yellow: output active (AUX+ connected through) • Red: output overload
OUT2	Switching status of output 2; LED yellow/red • Yellow: output active (AUX+ connected through) • Red: output overload

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3.2 Interfaces and connections



1. Safe input 1
2. Safe input 2
3. Output 1
4. Output 2
5. Addressing socket

Safety-integrated inputs

Socket	PIN	Description	Designation
S1	1	Mechanical switch 1+	S1+
	2	Mechanical switch 1-	S1-
	3	Mechanical switch 2+	S2+
	4	Mechanical switch 2-	S2-
	5	reserved	
S2	1	Mechanical switch 2+	S2+
	2	Mechanical switch 2-	S2-
	3	Not assigned	
	4	Not assigned	
	5	reserved	

Table 3.1 The pins 5 are reserved and should not be assigned.

Non safety-integrated outputs

Socket	PIN	Description	Designation
OUT1	1	Not assigned	
	2	Output 2 +	OUT2
	3	Output -	AUX-
	4	Output 1 +	OUT1
	5	Not assigned	

Socket	PIN	Description	Designation
OUT2	1	Not assigned	
	2	Not assigned	
	3	Output -	AUX-
	4	Output 2 +	OUT2
	5	Not assigned	
Flat cable connection		External bulk power +	AUX+
		External bulk power -	AUX-
		AS interface +	
		AS interface -	

3.3 Scope of supply

The following are included in the scope of supply:

- Safety module
- Jumper
- Blank plug
- Documentation

3.4 Accessories

Jumper

To assign a single mechanical switch to the device (e.g. emergency-stop category 2), attach a jumper to the vacant socket on the emergency-stop connection. Insert the blank plug supplied into the vacant socket to protect this jumper from dirt and prevent it from falling out.

4 Installation

4.1 Input connections

The switches are connected to M12 sockets. One or more series-connected mechanical switch can be connected for each channel.

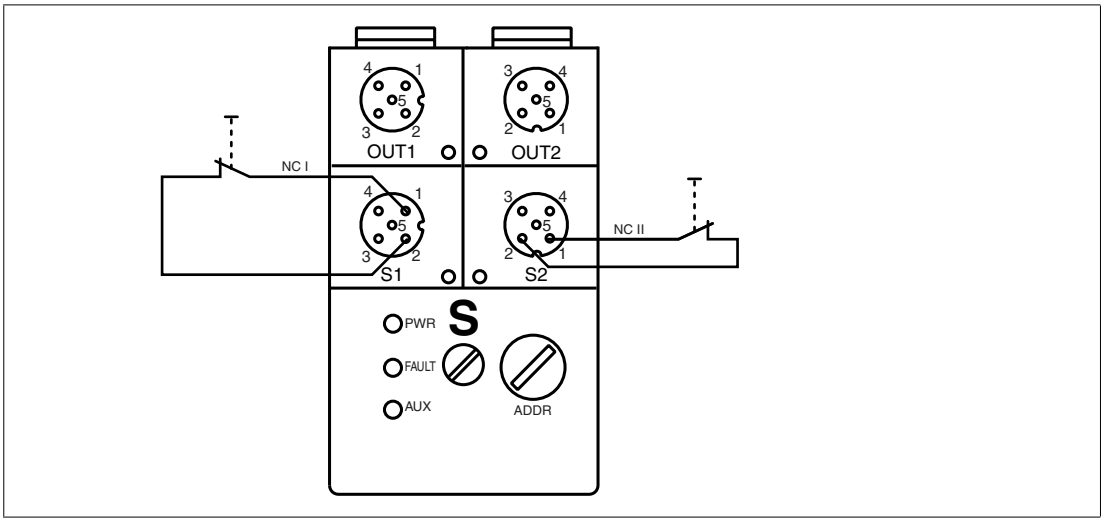


Figure 4.1

If a single-channel switch is used, use input 1.

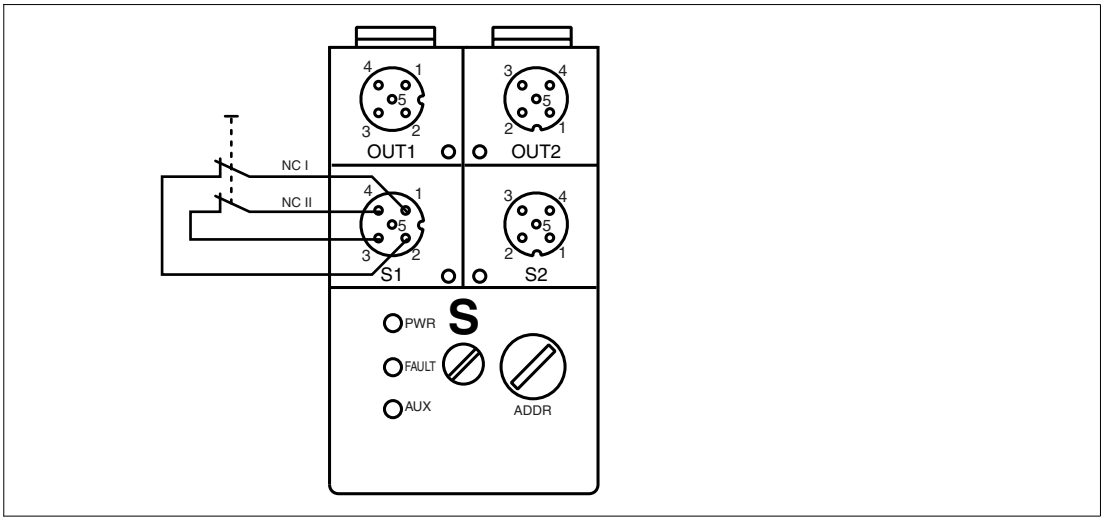


Figure 4.2

If input 2 remains blank, connections S2+ to S2- on the input must be bridged using the accompanying jumper. Secure the jumper using a blank plug VAZ-V1-B.

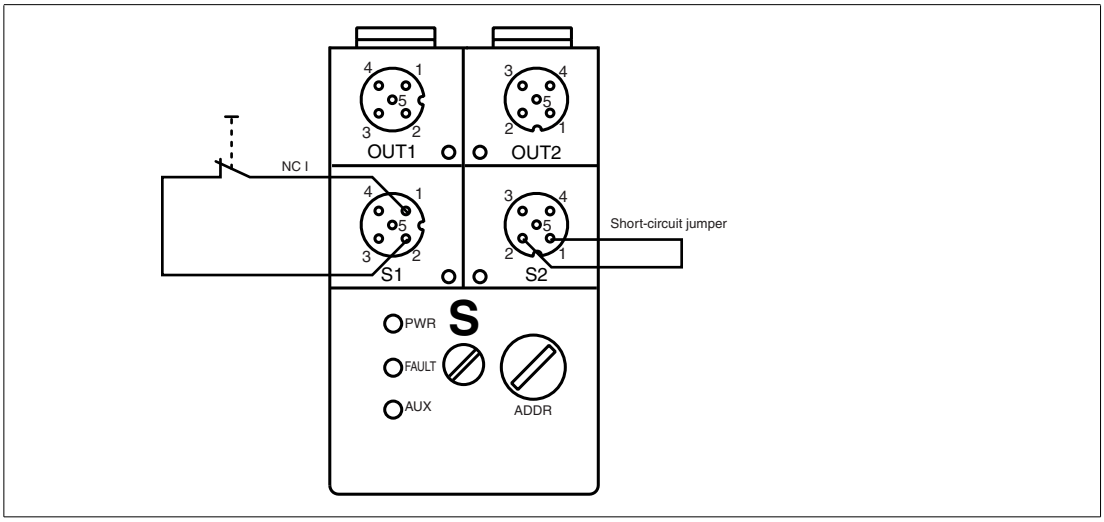


Figure 4.3 1 mechanical switch

Warning!

Electrical termination caused by moisture

The specified protection degree and the security function may not be guaranteed if the cable duct is not sealed correctly.

- Fit protective caps (e.g. VAZ-V1-B) to vacant connectors.
- Use rubber seals (e.g. VAZ-FK-ST1) for the cable ends.

4.2 AS interface

The G12 series module is connected to the AS interface via the integrated metal base. The components are connected by a yellow AS interface flat cable, e.g. VAZ-FK-S-YE.

Warning!

Electrical termination caused by moisture

The specified protection degree and the security function may not be guaranteed if the cable duct is not sealed correctly.

- Fit protective caps (e.g. VAZ-V1-B) to vacant connectors.
- Use rubber seals (e.g. VAZ-FK-ST1) for the cable ends.

4.3 Auxiliary power

The G12 series module is connected to the auxiliary power supply via the integrated metal base. The components are connected by a black AS interface flat cable, e.g. VAZ-FK-S-BK.

Warning!

Electrical termination caused by moisture

The specified protection degree and the security function may not be guaranteed if the cable duct is not sealed correctly.

- Fit protective caps (e.g. VAZ-V1-B) to vacant connectors.
- Use rubber seals (e.g. VAZ-FK-ST1) for the cable ends.

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5 Commissioning

5.1 Configuring the AS-Interface Safety Monitor

For details of necessary organizational measures affecting configuration of the safety monitor, please refer to the documentation for the safety monitor.

Safety Classification

The module contains two independent, redundant input channels. If both input channels are used, the module is suitable for use up to category 4/PL e in accordance with ISO 13849-1, or SIL 3 in accordance with EN/IEC 61508 and EN/IEC 62061. In this case, the monitor must be programmed so that dual-channel switching is monitored.

If a single-channel switch is used, the module is suitable for use up to category 2/PL c in accordance with ISO 13849-1, or SIL 1 in accordance with EN/IEC 61508 and EN/IEC 62061. Only tested and certified power supplies with safe isolation may be used to supply power. These power supplies must have PELV voltage in accordance with EN 50295/IEC 62026-2, and a minimum MTBF of 50 years. The power supplies are designed to exclude a short circuit between the primary and secondary sides.

5.2 Assigning an Address to the Module

Assign an address to the module using a handheld device or an AS-Interface master. You will need an extension cable, which is available separately, if you use a handheld device. You can assign addresses from 1 to 31. The default safety module address is 0.

5.3 Operational Testing

Perform function tests as part of the installation by activating the safety function. The operational test uncovers all existing faults at the time of installation. Because the safe inputs are monitored for crossed circuits, it is not necessary to test for short circuits in the cabling.

Note

In the case of single-channel safety functions, test the function for each channel.

For applications of category 4/PL e in accordance with ISO 13849-1 or SIL 3 in accordance with EN/IEC 61508 and EN/IEC 62061, the two inputs must be monitored using the safety monitor to ensure that they are synchronous.

Performing a Function Test

1. Activate the safety function by interrupting the input. This can be done by actuating a connected mechanical switch or on the cable.
2. Check whether the safety monitor detects the interruption without issuing a fault message.
3. Stop the interruption on the input on the connected mechanical switch or on the cable.
4. Enable the input on the safety monitor.

5.4 Operating mode

Activating operating modes for the inputs is not possible.

The parameters in the AS interface may influence the performance of the outputs. The chapter "Operating principle" contains a more accurate description.

6 Operation

Programming the safety monitor parameters defines the safety function of the device. Read the corresponding documentation.

6.1 Operating principle

6.1.1 Safety-Related Inputs

The module generates an internal code sequence. This sequence is monitored by a safety monitor (additional node) to ensure the correct order.

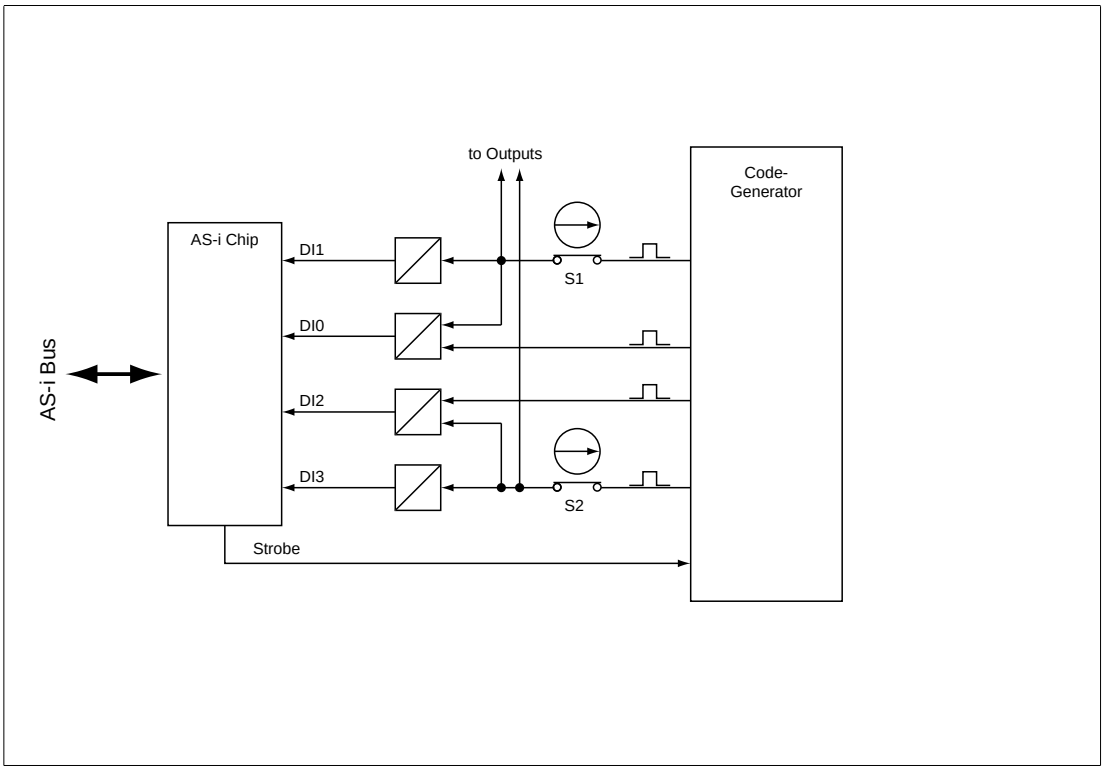


Figure 6.1 Code generator

The status of the externally connected mechanical switches influences the code sequence transmission.

Information regarding the activation of the connected mechanical switches (e.g. if the EMERGENCY STOP button is pressed, code transmission is interrupted) is transmitted as follows:

Activated input channel	Codebit 3 2 1 0
1	X X 0 0
2	0 0 X X
1 and 2	0 0 0 0
None	**X X X X**[1)]

Table 6.1 [1)] = working state

The code words 0000, XX00 and 00XX prompt the safety monitor to put the installation in safe mode (for instance using the EMERGENCY STOP button), without reporting a fault. If a code word bit differs from the target code word, the safety monitor will switch the installation to safe mode and will indicate a slave fault.

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The two input channels on the safety monitor are independent. The safety monitor can be programmed to monitor the input synchronicity for dual-channel applications.

6.1.2 Cross circuit monitoring of inputs

The inputs are monitored for cross circuits. The cross circuit monitoring function is able to detect low-ohm cross circuits caused by a metallic connection between the two inputs.

6.1.3 Safety Classification

The module contains two independent, redundant input channels. If both input channels are used, the module is suitable up to category 4/PL e in accordance with ISO 13849-1, or SIL 3 in accordance with EN/IEC 62061. In this case, the monitor must be programmed so that dual-channel switching is monitored.

If two single-channel switches are used, the module is suitable up to category 2/PL c in accordance with ISO 13849-1,or SIL 2 in accordance with EN/IEC 62061.

6.1.4 Non safety-integrated outputs

The outputs are designed in line with AS interface standards. Positive potential is applied to these outputs (PNP technology).

The status of the outputs is either determined by the master device or derived from the status of the inputs, depending on the operating mode set via the parameters on the AS interface master device.

The outputs can be operated in two modes:

- The outputs are controlled directly by the AS interface master device via the related data bits.
- The output signals from the AS interface master device are linked with the safe inputs. The outputs are activated by the master device or when the status of the inputs is safe. The purpose of this operating mode is to control signal lamps which indicate the status of the inputs without assistance from the master device.

Mode and logic table for outputs

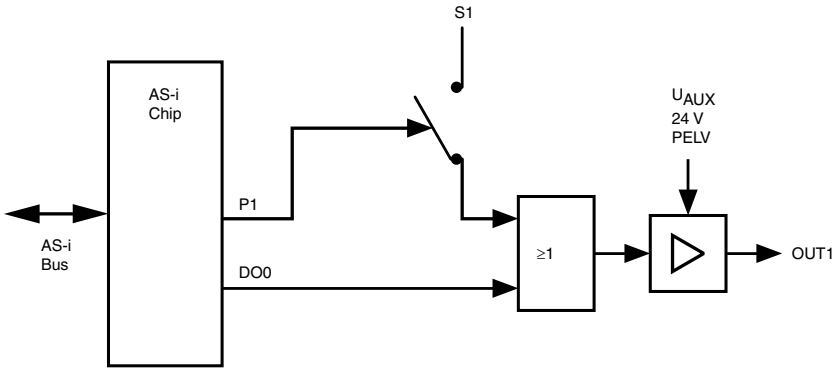
The master device selects the modes via parameter bit P1:

P1	S1 / S2 [1)]	DO0 / DO1 [2)]	OUT1 / OUT2	Mode
1	X / X	0 / 0	0 / 0	Outputs independent from the inputs
	X / X	1 / 1	1 / 1	
0	0 / 0	X / X	1 / 1	Open switch at input sets the related output
	1 / 1	0 / 0	0 / 0	The master device controls the output if the switch at the input is closed
	1 / 1	1 / 1	1 / 1	

Table 6.2

[1)] 0 refers to an open switch (safe status). 1 means a closed switch. X means any status that does not effect the outputs.

[2)] 1 means outputs are activated, 0 means outputs are voltage-free.


S1
AS-i
Chip
U_{AUX}
24 V
PELV
P1
AS-i
Bus
DO0
≥1
OUT1

7 Maintenance and repair

Regular function tests may be necessary, depending on the safety category.

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